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regularly. The whole length of this instrument is 2.75 inches, and the greatest breadth 1.33 inches. The shank is .8 of an inch broad and .3 of an inch thick. It was found at Corinth, Vermont.

Fig. 6 seems to be a badge of office, amulet, or something of the sort.* It is made of a very pretty breccia composed of light and dark material. It is finely wrought and very smooth, though not polished. The upper side is worked to a sharp edge, from which the sides round outwards towards the rectangular base, which latter has a hole at each end running obliquely through the ends. The length of the relic is 4.5 inches and the height nearly 2 inches. This was found about a mile north of Burlington, Vt. All these articles, except Fig. 2, are in the Museum of the University of Vermont. Besides such remains other traces of the Indian tribes are seen in the hieroglyphics. At Bellows Falls two rocks were found many years ago on which were rudely traced heads, a large group on one and a single head on the other. Some of these had rays coming from the top. Near Brattleborough, by the side of the river, a large rock was found which was covered with tracings of animals, as snakes, birds, etc., in all, ten figures, some not recognizable as representing any animal.

Such are some of the works which tell us of the former occupants of Vermont.

THE PRINCIPLES OF BEE BREEDING.†

BY FREDERICK WILLIAM VOGEL.

On the programme of the Sixteenth Annual General Convention of German Bee Keepers, held in the City of Nuremburg, on the 14th, 15th and 16th days of September, 1869, the first question was as follows:

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*Implements of this singular form and high finish have been found both in the mounds and on the surface throughout the South and West, but never to my knowledge have they been mentioned from any New England State before. They are always made of ornamental stone and perforated at their lower corner. Hardly two specimens are alike in their finish, though all have the singular general form given in the figure above. Squier and Davis (S. I. Contr. I, 239) give figures of three of these stones under the head of ornaments, but question their being simply for that purpose.—F. W. P.

† Translated from the German by Samuel Wagner, Editor of the American Bee Journal. From the Annals of Bee Culture, for 1870.

What is the value of mixed breeds of bees produced by crossing the Italian, the Egyptian, the Carniolian or Heath Bee, with the common Black Bee?

On the general subject of bee breeding thus introduced, but with incidental reference also to the production of improved breeds, Mr. Vogel, an experienced and accomplished bee keeper and breeder, of the Province of Brandenburg, in Prussia, who probably has more diversified, practical and experimental knowledge of it than any other apiarian, submitted the following remarks:

If we carefully consider the topics embraced in No. 1 of our programme, we shall recognize, as the substance of them, this query, "Is it possible to produce an improved breed of bees? And if so, what are the principles of breeding which we must adopt?"

I do not deny that on this question I shall speak with a certain degree of complacency, for that which I have to communicate is not derived from the indulgence of an idle fancy, but is based on observations made at the hive — the only sure, living, and pure source of apistical science.

In a discourse on the production of an improved breed of bees, we have to fix clearly in our minds the distinction between *variety* and *race*, for the two ideas are not unfrequently confounded, or used in a very arbitrary sense. The idea of *variety* includes a certain amount of constitutional properties. In bees there are among others, good or bad temperaments, swarming propensity or the want of it, disposition to build drone comb, etc., etc. Allow me to include all such constitutional properties under the general term *characteristics.* Variety, accordingly, is based on the characteristics. Corporeal markings, size and color, do not come into consideration in determining the idea of "variety." If the bees of any particular district are distinguished by a marked propensity for swarming, or by any other special characteristics, we are warranted in designating them as a "variety." Thus, in my estimation, the heath bees of Luneberg, those of Lower Austria, etc., etc., are simply new varieties of our well-known black bee. The peculiar constitutional properties which characterize varieties are rooted in the psychical or spiritual nature of the insect, and are elicited by the kind or quality of the pasturage, by particular modes of management, by diversity of climate, or some other dominating peculiarity of the district. Accordingly these constitutional properties disappear or are lost by lapse of time, by removal to a different locality, and thus subjecting the insect to other climatic influences and other conditions of management or pasturage. Hence, it is obvious that for the production of an improved breed mere varieties are of very subordinate account. At the same time, however, I contend that the production of an improved breed of *general value* — that is, one *equally suited to all parts* of an extensive country— is an impossibility. On the other hand, I am clearly of opinion that, for each particular district possessing marked peculiarity of climate and pasturage, an improved breed specially suited to those conditions may be produced. And in this aspect, the existing varieties of the honey bees are of high significance and value.

The meaning and extent of the idea expressed by the term *race* have long since been settled by science. The term embraces a certain amount of external corporeal markings, among which are size and color. When the bees of any extensive region, or even of a limited district, are found to be strikingly distinguished by their large or small size, by the color and quality of their pubescence, or of the tint of their dorsal bands, from the common type of the honey bee — assuming as such, for the present, our common black bee, we are warranted in designating them as a distinct *variety* or *race;* and that each variety or race has its own distinguishing constitutional characteristics is generally known.

I am not of opinion, however, that in order to produce or improve breed, recourse *must* necessarily be had to the foreign races which have been introduced among us, though it is often alleged that we should, from the start, have availed ourselves of them, and have endeavored thus to originate an improved breed.. But had that course been adopted, we should hardly ever have reached a satisfactory result. The pure races would have disappeared under our hands long before we could have succeeded in substituting an improved breed for them. It was much wiser to labor primarily to secure an ample stock of pure races, while at the same time the peculiar characteristics of each were assiduously studied. And now that both these points have been attained, we are placed in a position favoring and furnishing means and facilities, for the origination and production of an improved breed.

Permit me now to communicate the results of a series of experiments, all of which had for their object to ascertain the principles which should guide and govern us in the endeavor to produce and establish an improved breed of bees. The experiments instituted were so numerous, that they might be told by fifties or hundreds.

1. *Crossing the black bee with the Italian.*—When the Italian bee was introduced by Dzierzon, it was supposed that the workers produced by the Italian queen, fertilized by a black drone, would show an intermingling of the external markings of the parents. But this was soon found to be a mistake. In the second generation already, degeneration became apparent—the hybrids divided numerically, one portion resembling the Italian, and the other the black bees. For the purpose of experiment, I continued breeding in these two directions, and in the fourth or fifth generation reached again on the one hand the pure Italian bee, and on the other in the fourth degree, the pure black bee. The hybridism was thus again resolved into its *ataval* elements. The facts thus experimentally ascertained are, however, of very subordinate significance, elucidating only the coloration of the hybrids. Of higher and much greater practical value, on the other hand, is the solution of the inquiry:—"Do the constitutional characteristics of the two become commingled in the black-Italian hybrids? Or are those of the one variety or race simply transmitted to the other?" It is well known that very different answers have been given to these questions. Some breeders state that the hybrids of the black and Italian bees possess the constitutional properties of the Italians; while others allege the direct contrary. Some assert that the hybrids are more irascible than the black bees; others again say they are less so. Some declare that they will store more honey, while others say that they will store less, etc. The truth is, the constitutional properties of the two are of an exceedingly subtile nature, which makes it extremely difficult to base a reply on the results of a cross between them. It is only by crossing the black bee with the Egyptian that we can obtain any clear light on the point under consideration.

2. *Crossing the black bee and the Egyptian.*—When the Egyptian bee was consigned to me by the Berlin Acclimatization Society, I was of opinion that this bee was of little, or at most of only slight importance in a scientific point of view, for I supposed then that whatever was to be learned of the proposed mysteries of the bee, had already been revealed by means of the Italians. Now, however, I feel assured that *the future of apistical theory pertains to the Egyptian bee.*

Very soon some of the Egyptian queens became fertilized by drones. The workers produced by these queens were not perceptibly larger than the pure Egyptian workers, and in other respects still resembled the Egyptian type very much. The drones produced by these queens — since impregnation exerts no direct influence on them — were still pure Egyptian. I now raised some young queens from these impurely fertilized mothers, and employed the Kohler process to secure their fertilization by black drones. According to the experience derived from crossing the black bee and the Italian, the workers produced by such queens should have been numerically one-half black bees, and the other half Egyptian. But when the hybrid workers made their appearance our anticipations were not realized. The hybrids diverged in two directions indeed, but the parental markings showed themselves mingled or melted into each other, in a portion of the progeny. A portion of the workers resembled the Italian workers so perfectly, in color, size, and characteristics, that no expert could distinguish them from pure Italians. Another portion of them still resembled the Egyptian bees, showing a black body covered with a grayish pubescence, and manifesting the constitutional characteristics of the Egyptians. These observations led me to suppose that, probably ages ago, the Italian bee may have originated from a cross of the black bee with the Egyptian. I communicated this conjecture to Dr. Gerstaecker of Berlin and other friends. The latter received the suggestion with great disfavor, regarding it as derogatory and dishonoring the Italian bee, and it required no inconsiderable labor to convince them that the conjecture had no reference whatever to any supposed value or want of value of any variety of the honey bee, but was of a purely scientific nature; and that one variety might in economic value still rank high above another, though it be clearly demonstrated to be of hybrid origin. Dr. Gerstaecker informed me that he was unable to distinguish the workers produced by a cross of the black bee with the Egyptian, from the pure Italian workers; but that I had assigned no reason for my hypothesis, and that the geographical distribution of the honey bee militated against it. I then again carefully studied the excellent little treatise by Dr. Gerstaecker, on "The Geographical Distribution of the Honey Bee," and found that the geographical distribution of the races furnished no conclusive arguments either for or against my views. Here the idea occurred to me that the conjecture would attain to the highest degree of probability, if a hybrid queen of the second or third generation should be found to produce drones which could not be distinguished from Italians. Impatiently did I await the return of spring. The drones finally made their appearance and diverged likewise in two directions; one portion could not be distinguished from Italian drones, while another portion resembled the Egyptian drones in size, but having black bodies with grayish pubescence. I then raised young queens from an Egyptian hybrid queen of the second degree of degeneration, and arranged to have them fertilized by drones derived from the same mother, but bearing Italian markings. The workers produced by these queens resembled the Italians, while the drones diverged in the two directions adverted to. I now proceeded to breed in-and-in from the hybrids thus obtained, and in the third and fourth generations *all* the drones bore the Italian markings. It might here be objected that on ataval principles, these hybrids must revert to their distinct parental or primal races, as is the case with hybrids of the black bee and the Italians. But I have now before me black Egyptian hybrids of the nineteenth generation, and these still retain their characteristic markings unchanged alike in queens, and drones, and workers, though rather intensified in degree and permanence. Firmly established, therefore, do I regard this fact—*From a cross of the black bee with the Egyptian, a hybrid is produced which no man can distinguish from the Italian bee.*

Now what do these observations teach? For brevity's sake I will express the question thus:—Did Divine Omnipotence, when placing the animal creation upon the earth, provide in each case only *one* primitive pair? Or did He create each race at once in larger groups? And if the latter, were all the animals of the same class perfectly alike as regards size and color? Or did God create directly the different *races* of the honey bee? When we reflect that no mortal eye witnessed the grand act of creation, and further consider that no reply can be deduced from any known laws of nature, they may be regarded as highly presumptuous. But the arrogance apparently involved in them vanishes at once, when I state that I have not deduced the reply from my own mental cogitations, but from facts with which I became acquainted when crossing the common black bee with the Egyptian. My observations constrained me to accept two primitive races for the honey bee. A portion of each of these races certainly existed since the dawn of history, and these I denominate *original* or *primary* races. In the course of time others arose from the crossing or intermixture of the primary races and these I call *derivative* or *secondary* races, or *varieties.* The black bee and the Egyptian I regard as primary races. The Italians, Crecropians, Syrians, Chinese, etc., etc.—"Who can count the peoples? who name their names?" all these are nothing more than the hybridous products springing from the two original races — mere derivative or secondary races. I venture to say that if all these mixed products be entirely removed, leaving me only the pure black bee and the pure Egyptian, I could speedily reproduce any desired secondary race, by crossing those two primaries. Possibly, the strikingly black honey bee of Madagascar may yet prove to be another primary race.

3. *Crossing the Italian bee and the Egyptian.* — What has hitherto been said is of subordinate importance, so far as regards the production of an improved breed, because it refers only to the color or markings which it may be thought desirable to give to the improved breed. But of higher and more practical importance is the solution of the questions, Is the constitutional temperament of one race transmissible to another? And if so, is this to be effected by means of the queen or drone? Or, again, do the constitutional properties of the two races or varieties become so commingled or melted into each other by the cross, that new and special constitutional properties are the result? In breeding we have hitherto relied mainly on the queen. We said — "this is a choice, populous colony with a fine prolific queen, therefore we must use some of its blood for raising queens." But I do not believe that, in the endeavor to procure an improved breed, it is sufficient to have regard only for the qualities of the queen. According to my observations, those of the drone, too, must be taken into account.

In order to accumulate facts, it became necessary to cross the Italian bee with the Egyptian, because these two are the exact counterparts of each other, as regards constitutional characteristics — the Egyptians having a fiery temperament, while the Italian is of a placid and gentle disposition. The first inquiry was: — Does the temperament reside in the seminal filament, or in the egg? In other words, is the seminal filament the germ of the young bee, or is the egg?

When first the seminal filaments were discovered in the generative fluid, it was thought that each was the incipient germ of a nascent creature; and that the young animal is nothing more than a fully developed seminal filament. Accordingly, it was assumed that the egg only contained the requisite nutriment for the sustenance and development of the seminal filament. Now, if this were in reality the germ of the nascent creature, the constitutional properties must be inherent in the drone. But every bee breeder is aware of the fact that an unimpregnated queen lays eggs which produce drones exclusively; and he further knows that worker bees occasionally lay eggs from which living creatures are developed, and that these are invariably drones. From these facts it is evident that *the egg contains the germ of the young bee.* Let us now inquire what observation and experiment further teach. I crossed pure Egyptian queens with Italian drones. In the hybrid progeny, the constitutional properties — the temperament — of the Egyptian seemed completely obliterated, as it were, and those of the Italian substituted. I next crossed the Italian queens with Egyptian drones, and the progeny displayed the Egyptian characteristics wholly. Hence, it was manifest that *the temperament of the bee resides in the seminal filament.* Accordingly, in our endeavors to provide an improved breed, our attention must be preëminently directed to the drones by which the selected queen is to be fertilized. We come now to the question whether drones possess diversities of temperament; but the elucidation of this branch of our topic would occupy too much time at present. I may perhaps have occasion hereafter to discuss it.

Some may dissent from the views I have here expressed, but we cannot disagree in our object, namely, by steadfast endeavor and close scrutiny to attain to the knowledge of the truth which the Omniscient has embodied in that very diminutive member of animated nature, the Honey Bee.

HABITS OF THE PRAIRIE DOG.

BY PROF. B. C. JILLSON, PH.D.

October 26th, 1869, I received two Prairie Dogs, which had been forwarded from Cheyenne, Wyoming Territory. They were about the same size, each measuring thirteen inches in length, the